

REMARKS

The present Amendment is in response to the Office Action having a mailing date of January 16, 2004. Claims 1-12 are pending in the present Application. Claims 1-5 and 7-11 are rejected. Claims 6 and 12 are objected to. Claims 1-12 have been amended. Claims 13-16 have been added. Consequently, claims 1-16 are now pending in the present application.

Drawings

The Examiner states,

1. The drawings filed on April 4, 2001 are acceptable subject to correction of the informalities indicated on the attached "Notice of Draftperson's Patent Drawing Review," PTO-948. In order to avoid abandonment of this application, correction is required in reply to the Office action. The correction will not be held in abeyance.

The drawings have been amended in accordance with the "Notice of Draftperson's Patent Drawing Review" as recommended by the Examiner. Figures 1 and 3 have been amended to include better line quality and to improve the legibility of numbers, labels, and legends. Replacement drawing sheets, including Figures 1 and 3, which incorporate the desired changes and which comply with 37 C.F.R. 1.84 accompany this response. Formal drawings will be provided upon allowance of the application.

Claim Objections

The Examiner states,

2. The claim 5 and 11 are objected to because they include reference characters that are not enclosed within parentheses.

Reference characters corresponding to elements recited in the detailed description of the drawings and used in conjunction with the recitation of the same element or group of

elements in the claims should be enclosed within parentheses so as to avoid confusion with other numbers or characters which may appear in the claims. See MPEP 608.01(m).

Claim 5, lines 8-10, limitations of “(302 and 304; and” appear to be missing a close parentheses.

Claim 5, line 2, performing step (206) appear to be in error. As per figure 2, performing step is (204) and providing step (206).

Claim 11, line 3, performing step (206) appear to be in error. As per figure 2, performing step is (204) and providing step is (206).

The reference numerals have been deleted in all of the claims.

Claim Rejections – 35 USC 112

The Examiner states,

4. Claims 4, 8 and 10 recite the limitation: “the providing step (206)(b)” in line 1. There is insufficient antecedent basis for this limitation in the claim.

The use of step (206)(a) or (b) appear to be indefinite and need to be used in proper context of previous steps or figure elements.

The reference numeral 206 has been deleted from the claims.

Present Invention

A method and system for quantification of strain imaging is disclosed. The method and system comprises performing a motion analysis on at least two regions of interest. The method and system further includes providing a strain estimate for each of the at least two regions of interest based on the motion analysis and comparing the strain estimates of each of the at least two regions to quantify the strain for the at least two regions of interest.

A system and method in accordance with the present invention provides for strain quantification based on conventional B-mode images. Using this technique, the strain of regions of interest (ROI) defined by users can be determined and quantitative comparisons can be effectively made in real time. The strain quantification can be used to determine tissue's properties and can potentially be applied in breast imaging as well as cardiac imaging.

Claim Rejections – 35 USC 103

The Examiner states,

6. The application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-3, 5, 7-9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hossack et al. (US 5,873,830) in view of Ophir et al. (US 5,178,147).

Regarding claims 1-3, Hossack discloses an ultrasound imaging system for improving the resolution comprising the steps of:

performing a motion analysis on at least two selected Regions of interest (ROI) before and after tissue compression (column 22, lines 25-55 and column 7, line 64 through column 8, line 10).

Hossack discloses a medical imaging system for imaging tissue under a predetermined compression profile without specific details regarding the steps of providing a strain estimate and comparing the strain estimates.

In the same field of endeavor, however, Ophir discloses an elastographic measurement and imaging system comprising the steps of providing a strain estimate and comparing the strain estimates for at least two ROIs (column 9, lines 9-47).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the steps of providing and comparing strain estimates as taught by Ophir in the system of Hossack because Ophir provides Hossack with a system which allows Hossack for accurate, localized determination and imaging of important parameter, compressability, which has been used qualitatively in medicine for a very long time.

As to claims 2-3, Hossack discloses the steps of generating a plurality of blocks and utilizing block-matching technique touching a boundary of the two regions (column 10, lines 40-60 and column 13, lines 20-34). All other limitations of claims 2-3 are similarly analyzed as claim 1 above.

As to claim 5, claim 5 recites substantially very similar limitations as claims 1-3 above and is similarly analyzed.

As to claims 7-9, claims 7-9 are a computer readable medium claims corresponding to method claims 1-3 above and are similarly analyzed.

As to claims 7-9, the steps claimed as computer readable medium is nothing more than restating the function of the specific components of the method as claimed above and therefore, it would have been obvious, considering the aforementioned rejection for the method claims 1-3.

As to claim 11, the steps claimed as computer readable medium having program instructions is nothing more than restating the function of the specific components of the method as claimed above and therefore, it would have been obvious, considering the aforementioned rejection for the method claims 1-3.

Applicant respectfully disagrees with this rejection.

Applicant agrees that Hossack does not describe providing a strain estimate and comparing the strain estimates. Ophir describes a conventional strain measurement apparatus in which strain images are created by comparing echo data obtained before and after a slight compression of the tissue. There are problems with this system.

Typically strain images are made from strain measure point by point, pixel by pixel, before and after compression. However, there are several problems with this type of method for quantifying the strain. First, there are artifacts that can be generated based on the probe usage over several points. Second the system is time-consuming and tedious. Thirdly, other areas can distort the measured strain due to shadows, cavities and other areas of anomalies within the area being imaged.

The present independent claims provide a strain estimate for estimating each of the at least two regions of interest (ROIs) based upon the motion analysis and compares

the strain estimates of each of the at least two ROIs to quantify the strain for the at least two ROIs.

The combination of Hassock and Ophir yields the conventional strain estimate measurement which as before mentioned is tedious, time consuming and can be inaccurate.

Accordingly, Applicant respectfully submits that independent claims 1, 5, 7 and 11 are allowable over the cited references. In addition, claims 2-4, 6, 8-10 and 12 are allowable because they depend from allowable base claims.

Accordingly, Applicant respectfully requests allowance of claims 1-12 as now presented.

Allowable Subject Matter

The Examiner states,

8. Claims 4, 6, 10 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, providing the rejections of claims 4 and 10 is overcome under 35 USC (sic) USC 112 above.

Claims 13-16 are claims 4, 6, 10 and 12 written in independent form. Applicant submits therefore that they are in allowable form.

Accordingly, Applicant respectfully submits that claims 1-16 are now all in allowable form. Consequently, allowance and passage to issue of claims 1-16 of the present application are respectfully requested.

Applicant's attorney believes that this application is in condition for allowance.

Should any unresolved issues remain, Examiner is invited to call Applicant's attorney at the telephone number indicated below.

Respectfully submitted,

April 15, 2004
Date



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